CHAPTER 4

IMPACT OF NON-FARM ENTERPRISES INCOME ON DIETARY DIVERSITY, EXPENDITURE DIVERSITY, AND FARM INVESTMENT

4. The Impact of Non-Farm Enterprises Income on Dietary Diversity, Expenditure Diversity, and Farm Investment in Rural India: Evidence from Longitudinal Data

4.1. Introduction

Fundamental characteristics of the structural transformation of an economy is a decrease in dependence on the agriculture sector, both as a source of income and employment. The transition from agriculture is a combination of the "pull" and "push" factors. Pull factors operate through the productivity growth in agriculture, resulting in higher income and farm households slowly diversify their consumption baskets out of less nutritious to highly nutritious food items and then from food products towards a greater share of non-farm products and services (Haggblade, Hazell and Reardon, 2010). On the other hand, the reduced yields from land and labor which causes an agricultural revenue stagnation could "push" farm households to participate in other economic activities.

Further, small per capita land, and restrictive credit opportunities in developing countries such as India, generates a surplus of labor in the sector and restricted access to the latest technologies for capital investment causes low income and poverty in rural areas. Moreover, low farm incomes, fluctuating prices of agricultural goods are related to the risk and uncertainty of the agricultural sector. These factor leads to increase in non-farm activities of the households which is an important instrument for creation of their well-being, poverty reduction, and also to absorb the expanding agricultural workforce (Lanjouw and Lanjouw, 2001).

Pathways from agricultural income to consumption expenditure (Kanter *et al.*, 2015), often tend to overlook the significance of non-farm income for expenditures on non-food goods and services, which can be an issue of concern. Non-farm activities are a substantial source of revenue in rural locations. Revenue from non-farm activities accounts for approximately 35 percent of overall rural income from Africa and roughly 50 percent in Asia and Latin America (Haggblade, Hazell and Reardon, 2010). Back in India, 88 percent of those rural families which are mainly engaged in agriculture and allied activities, additionally tackle supplementary economic activity against the non-farm sector (Chandrasekhar and Mehrotra,

2016). Few studies analyze the consequences of non-farm earnings on the agriculture sector, and their findings are mixed. In Malawi, (Alwang and Siegel, 1999) discovered that, though wages from working outside the farm are low, smallholders value the incentives that they supply as a means to achieve food security. This creates labor shortages on smallholder farms. Other research suggests that nonfarm earnings may be a means to conquer working capital limitations and purchase inputs for farming or make capital improvements on farms (Barrett, Reardon and Webb, 2001).

Against the above background, this chapter is an attempt to investigate empirically into the relationship between the additional income of farm households received from non-farm enterprises[1] and their diversification in consumption expenditures measured as dietary and expenditure diversity together with farm investment. We focus on rural India as the country of investigation in which non-farm income opportunities are a significant driver behind the process of structural transformation. Dietary diversity and transition from food expenditure to non-food expenditure as a measure of human development or welfare stays underexplored in the Indian scenario, particularly in the context of distinct agro-ecological zones where the discourse on hunger and food safety continues to be synonymous with poverty. Dietary and expenditure diversity, tell us about real consumption and the ability of a household to acquire nutritional food first then spend more on non-food items, which is critical for human development. Also, establishing the connection between non-farm income and consumption expenditure as a whole appears simple and well documented in the existing literature; however the nature of the relationship between the rural non-farm enterprises' income and diversification in diets and non-food expenditures with dynamics of farm investment is not clear. Apart from this, it is also important to understand that as an

[1] *Rural non-farm entrepreneurship is described as any sort of business activity in the non-farm economy that is undertaken by any member of farm household. We considered only those rural households whose primary source of income is agriculture and in addition to that one or more members of the household started and managed any non-farm enterprises. They consist of many heterogeneous activities like food-processing, construction, transport activities, sales and trade services* (Wiggins and Hazell, 2011).

increasing share of a rural farm household's workforce changes into non-farm activities, do non-farm enterprises work to compete with or complement farm activities? Answers to these questions are vital for understanding the consequences of this rural economic transformation for agricultural competitiveness and the welfare of farm households.

The objective of the present study is to empirically analyze the effect of non-farm enterprises income on (i) dietary diversity (ii) expenditure diversity and (iii) farm investment. We used longitudinal farm households' data from rural India, gathered in 2004-05 and 2011-12. Our econometric technique utilizes the panel data analysis and instrumental-variables (IV) strategy to control for the endogeneity of non-farm enterprises income.

The rest of the chapter is organized as follows. In Section 4.2, we outline the present state of knowledge on non-farm activities in developing countries and its analytical framework. In Section 4.3 discusses the empirical strategy employed in the chapter, and Section 4.4 reports the empirical results. Finally, Section 4.5 concludes the study.

4.2. Review of Literature

The empirical assistance of the effect of non-farm activities on poverty and food security in developing nations is well recorded (Owusu, Abdulai and Abdul-Rahman, 2011; Hoang, Pham and Ulubas, 2014; Imai, Gaiha and Thapa, 2015). Research shows that non-farm income might provide self-insurance against shocks that might occur to the household, conquer farm credit limits, increase farm investment, absorb labor excess, and ultimately move out households from poverty through improved overall incomes (Emran and Hou, 2013). Non-farm income not merely reinforces purchasing power but also reduces the danger of intra-year food accessibility and other essentials (Ellis, 1998). Extant literature has primarily focused on the implication of livelihood diversification into non-farm activities on growth and poverty but has not devoted adequate attention to its effects on various consumption expenditures and farm investment. However, non-farm income could influence

dietary and expenditure diversity through multiple pathways. Higher income raises household access to higher quantity and a greater assortment of foods on the one hand, and on the other hand, they could spend more on non-farm goods and services, or they might prefer to invest more on durable household assets. Aside from such expenses, higher income may also allow them to invest more in agricultural pursuits.

Researching these questions is complicated as it is difficult to demonstrate that the directionality of these causes and effects of additionally obtained NFEs income by farm households. Low or shaky farm earnings might be a push factor forcing farm households to search for additional earning opportunities away from agriculture, especially from households that are land restricted or insufficient access for irrigation. The loss of household labor to non-farm enterprises can impact diversifications in consumption expenditure and agricultural production activities in complex ways. Non-farm enterprises income may offer liquidity and income security, permitting farmers to make productivity by enhancing investments when accessibility to insurance and credit from formal or informal sources isn't offered.

4.2.1. Rural Non-Farm Activities and their Importance in Developing Countries

By examining the importance of non-farm economic activities for farm households, (Janvry and Sadoulet, 2001) find that the non-farm activities contribute on average 55 percent to rural household income in Mexico, whereas (Escobal, 2001) reports a figure of 51 percent for Peru. (Lanjouw and Lanjouw, 2001) report 39 percent for Brazil, 41 percent for Chile, 50 percent for Colombia and 59 percent for Costa Rica and (Shi, Heerink and QU, 2007) report 46 percent for China. (Ellis, 1998) argues that livelihood diversification towards non-farm activities plays a substantial role in maintaining food safety levels through smoothing food intake over time. Non-farm income could improve food safety, even for the households who cannot invest in agriculture by obeying their food intake over time or ameliorates the food deficit risks in the event of unexpected crop failures (Qureshi, Dixon and Wood, 2015).

Results from different countries do also indicate that non-farm income has important consequences for food safety in addition to for non-farm goods and services (Babatunde and Qaim, 2009; Mishra and Chang, 2012; Mishra, Mottaleb and Mohanty, 2015).

The present literature available on the non-farm enterprise is mostly focused on enterprises in developed markets (Martin, Mayer and Mayneris, 2011; Rijkers and Costa, 2012; Bloom, Schankerman and Reenen, 2013). Just a few studies have analyzed the implications of non-farm enterprises in less developed and developing countries. These have a tendency to focus either on formal or production enterprises and are overwhelmingly urban-based (Frazer, 2005; Klapper and Richmond, 2011; Ali and Peerlings, 2012). On the other hand, it is also well documented that the majority of non-farm enterprises are small and informal businesses (Nagler and Naudé, 2017), together with 95 percent of rural non-farm enterprises employing less than five employees (Haggblade, Hazell and Brown, 1988). As stated by (Junior R. Davis and Dirk Bezemer, 2014) 44 percent of households in rural Africa take part in the non-farm pursuits, at which self-employment leads to an average 15 percent to total household income. Another notable fact is that entrepreneurship in Africa leads less to household income in comparison to other regions (Davis *et al.*, 2010; Junior R. Davis and Dirk Bezemer, 2014). In India, which is located beyond the transition world, rural non-farm employment accounted for roughly 20 percent of total employment, or roughly 70 million non-farm workers, in 2000 (Mukherjee and Zhang, 2005), playing a considerable role in non-farm earnings and poverty reduction (Foster and Rosenzweig, 2004). We consider below two interrelated reasons that may account for this condition: firstly; the issue of heterogeneity in consumption expenditure information and instant; the adherence to neoclassical demand theory which solely concentrates on describing the change in expenditure behavior concerning income and price effects.

Summarizing the literature survey, we conclude that non-farm enterprises in rural areas of developing countries such as India are small, informal businesses operated because of

both opportunity and necessity, and contributing with a substantial share to rural farm household incomes as well as consumption expenditure. However, it is required to be researched that how farm household prefers to spend their marginal income received non-farm enterprises?

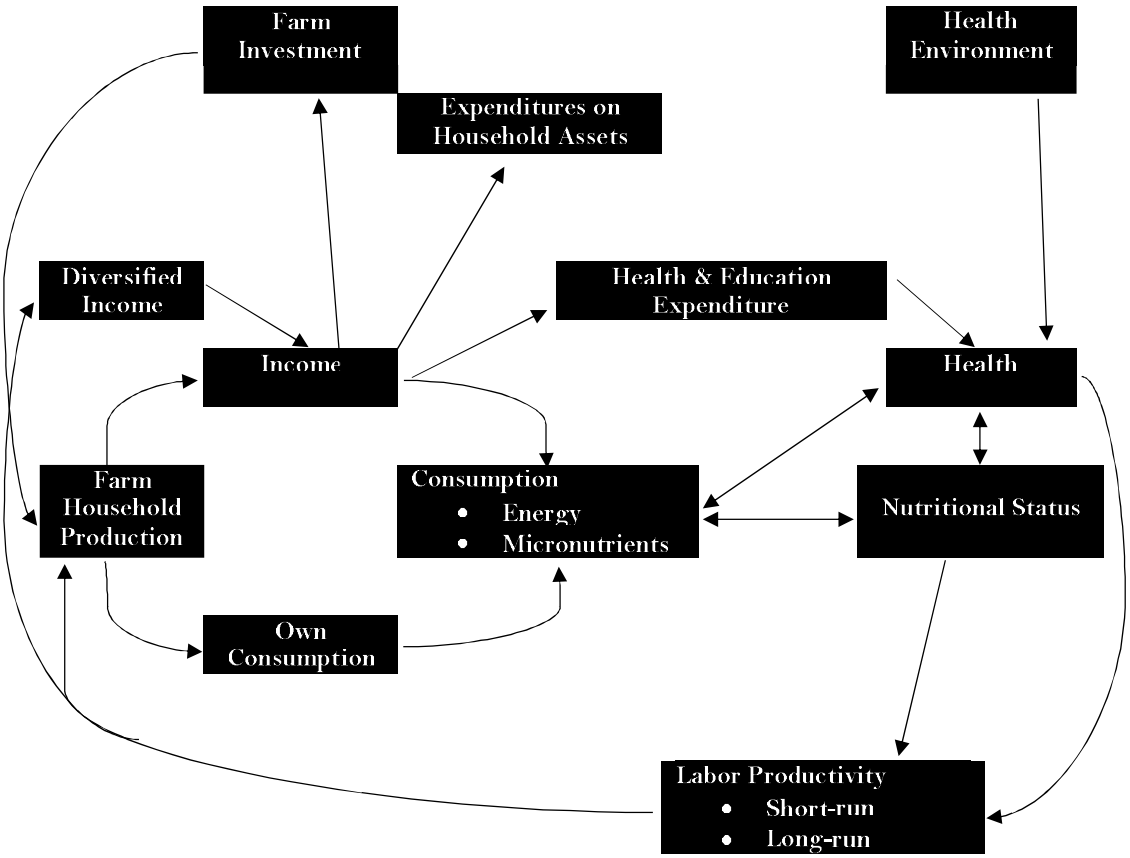
4.2.2. Analytical Framework

(Chung, 2012) introduced a conceptual framework to understand linkages between agriculture, income sources and different consumption expenditures, which describes a set of connections that explain the mutual dependence of agriculture, nutrition, and wellness. The framework features looping connections that exemplify the bi-directional linkages, and consequently interdependence, among their key elements. Changes in health or nutrition status are expected to impact farm in addition to non-farm income; conversely, changes in the income status can have significant impacts on nutritional and health status.

Figure 4.1 summarizes a simple framework for assessing income-consumption expenditure linkages of farm households in rural India and highlights the interdependent relationships that connect farm and diversified income with different consumption expenditures, nutrition, and health status at the household and individual levels. Our focus is on the effects of diversified income on dietary and expenditure diversity and, because of this, we have not analyzed how farm and diversified income affects health status and, indirectly, nutrient status. The left-hand side of figure 4.1 reveals that farm household production is expected to improve individual food consumption by (a) increasing consumption from own production or (b) contributing to household income for buying food. Subsequently, improved food intake offers energy that is required for bodily expansion, maintenance, and action. A high-quality diet also supplies protein and various micronutrients (vitamins and minerals) which are essential for optimal growth and functioning.

Since agricultural activity determines, to a great extent, the amount, kind, stability, management and distribution of income, the linkages between agriculture and consumption are expected to be strong and direct for farm households (Chung, 2012). Additional agriculture affects the food available for consumption by the household, including its diversity, quality, and price (Braun, Ruel and Gillespie, 2011; Chung, 2012). Whether increases in output or the relative value of non-farm income contributes to increased diversifications in consumption expenditure is an empirical question that has to be tested.

Figure 4.1: Linkages between Farm Household Incomes and their Consumption Expenditures



Sources: Conceptual Framework is adopted from Kimberly Chung (2012) and presented with Authors' modifications.

4.3. Empirical Strategy

4.3.1. Data

Out of 40,018 common households, 14,250 are the rural farm households as their primary source of income is agriculture and they reside in rural areas. In this chapter, we use information of 14,250 longitudinal rural farm households which includes both diversified farm household (1,822 mentioned in table 4.1) and non-diversified farm households (14,250 – 1,822 = 12,428). Hence, diversified farm households are about 12.8 percent (diversified farm households / total farm households * 100).

4.3.2. Measurement of Household Level Dietary and Expenditure Diversity

Dietary diversity was calculated by aggregating food expenditures that questionnaire respondents reported consuming at the 30 days prior to the interview into 9 equally weighted categories: (1) cereals, (2) sugar and sugar products, (3) pulses, (4) fish, eggs and meats, (5) edible oil, (6) milk and other dairy products, (7) vegetables, (8) fruits and dry fruits, (9) other food items. Foods included in the dietary diversity came from the following sources. (i) foods bought outside but consumed in the household, (ii) values of home-produced foods, (iii) foods obtained as gifts, and (iv) foods bought and consumed outside the home.

The dietary diversity assesses the existence of different food groups within a household's meals/ nevertheless it does not capture differences in the distribution of consumption, as all categories are equally weighted irrespective of quantity consumed. The exact same dietary diversity score of, say 9, according to a total of nine food groups, might actually reflect two quite different diet diversity scenarios, with one representing consumption of relatively large amounts of a very few of specific food groups but very little amounts from each of the other food items within the recall period, another representing an even distribution of consumption across the nine groups. Therefore, higher dietary diversity scores could be more or less meaningful based on the relative share of each food consumed (Arimond and Ruel, 2004).

To mitigate this issue, we used an additional diversity measure -- the Simpson index (Simpson, 1949) to estimate the relative concentration or "spread" of food expenditure. The value of the index is calculated as follows:

$$\boldsymbol{Simpson\ Index = 1 - \sum_i w_i^2} \qquad (4.1)$$

Where w_i is the expenditure share of food category i. The Simpson index ranges between zero to one; a value of zero suggests only one food category has been consumed while a value nearer to one means a more diversified diet or even a more equal distribution of food expenditure by food type has been consumed inside the sample instance.

This index was also utilized to quantify diversity in total consumption expenditure by accepted a vast array of expenditures under the account. Given the flexibility of our data, we split expenditure on non-food goods and services into two parts according to their character of durability and recall periods. To compute expenditure diversity, we have disaggregated overall consumption expenditure into six different expenditure groups, namely -- (1) food expenditure, (2) non-food expenditure, (3) expenditure on household assets, (4) farm investment, (5) money holding[2], and (6) miscellaneous expenditures. The Simpson Index is a member of a class of diversity index that takes into account not only whether or not each kind of expenditure happens, but also the equal value of each form of consumption expenditure. Expenditure diversity also ranges from zero to one. If a household spends all of the earned NFEs income only on one kind of expenditure, the index will be zero, hence, no expenditure diversity. If NFEs income spends on various kinds of expenditure, the index value will approach to one, which suggests more expenditure diversity.

[2] *Money holding refers to cash in hand for precautionary purposes.*

4.3.3. Econometric Model

We estimate panel regression models, because of two reasons (Baltagi, 2005). First, we would like to control for household level heterogeneity; NFEs income might be systematically correlated with some unobservable parameters. Secondly, we wish to monitor how a change in NFEs income is related to change in diversity-patterns of a farm household over a period of time. The panel regression model is of the following form:

$$\boldsymbol{Y_{it} = \alpha_i + \beta_1 NFE_{it} + \sum \beta_{it} X_{it} + u_{it}} \qquad (4.2)$$

where Y_{it} is the outcome variable, NFE_{it} is the income received from non-farm enterprises, X_{it} are the set of household level socio-economic control variables. We control for several observable household characteristics including caste, religion, educational attainment, household size, access to the credit, possession of livestock, access to household amenities (toilet and electricity), land owned and membership of credit savings and agricultural cooperatives in our regression models. Household-level time-invariant unobservable characteristics have been accounted for by α_i. The regression models also control for an agroecological variable that broadly capture climatological conditions which influences the soil characteristics and farm productivity potential.

We are interested in estimating β_1 which is the effect of NFE income on the outcome variables. It is likely that households which have higher NFE income are also the ones who are already consuming better food, now they are more likely to diversify their expenditure in non-food consumption and/or invest in farm activities. Using a panel data regression model, does not entirely take care of the simultaneity between NFE income, dietary and expenditure diversity. More food secure households are more likely to engage in non-farm activities and this could lead, in turn, to a more diverse diet. This simultaneity may be compounded if the non-farm income and the measures of dietary and expenditure diversity are correlated with some unobservable factors. Apart from this, some household and village characteristics are

absent from the survey data, for example, household distance from urban markets and household head's entrepreneurial skills, which can influence non-farm enterprises income. The presence of unobserved heterogeneity could bias our results, so to deal with it we use an instrumental variable (IV) approach.

4.3.4. Instrumental Variables used in the Study

The Instrumental variable (IV) approach is useful in the case of potential endogeneity. Here, NFE income is the endogenous variable, since it was correlated with the error term. Hence, outcome variables could be influenced by other factors which do not affect outcome variables directly but through NFEs income. Unobserved heterogeneity could, therefore, lead to measurement errors and bias our estimated coefficients on β_1. In the IV approach, we need to find an instrument z which is correlated with changes of the endogenous variable (here, NFE_{it}), but not with the outcome variable. Put simply, we need one or more variables as an instrument for NFE_{it} which does not affect Y_{it} directly, but through its effect on NFE_{it}. Here, we use two different instruments to circumvent this potential endogeneity. We use the road density in the district and number of household members engaged in non-farm enterprises as instruments for non-farm enterprises income.

Our selection of Instrumental Variables is advised by the present literature that has demonstrated that improved road-access are thought of as significant pathways to escape poverty (Khandker, Bakht and Koolwal, 2009). This is based upon the assumption that increased market access and reduced transportation costs reduce obstacles to take part in non-farm activities (Binswanger and Khandker, 1993; Fafchamps and Shilpi, 2003). Specifically, (Jacoby and Minten, 2009) show that the reduction in transportation costs is associated with increasing household welfare mainly through favorable non-farm revenue shock. More especially, for the Indian scenario, (Asher and Novosad, 2017) empirically demonstrate how road access has led to greater involvement in non-farm activities resulting in structural

transformation in rural India. Using the IHDS data, (Lei, Desai and Vanneman, 2017) have also demonstrated that access to roads positively influences involvement in non-agricultural work in the villages. (Aggarwal, 2018) reveals that villages that received paved road access under the Pradhan Mantri Gram Sadak Yojana (PMGSY) saw an observable shift in the occupational pattern. Most notably, women in the age-group 14-20 shifted to occupations like animal rearing, tailoring, and textile manufacturing.

Our other instrument, number of household members participated in non-farm enterprises for extra income from the non-farm business is also in accord with the present literature which looks into the impact of non-farm activities on several outcomes including food safety. As an example, (Kilic *et al.*, 2009; Olale and Henson, 2013) apply the district level share of non-agricultural employment as a tool for off-farm income.

4.4. Empirical Analysis and Results

4.4.1. Descriptive Statistics

This section analyzes some descriptive statistics for the principal variables used for the present study. Using IHDS longitudinal data, we describe: (1) outcome variables – household level distinct food and non-food consumption expenditures, dietary and expenditure diversity outcomes and farm investment; (2) endogenous variable – degree of non-farm enterprises (NFEs) involvement measured as income received from NFEs; (3) instrumental variables; and (4) selected household characteristics, such as religion, caste, education attainment of household head, land size, accessibility of credit, etc and results are presented in table 4.1. It indicates that about 13 percent of those 14,250 rural farms households engaged in the non-farm enterprise (NFF). The typical natural logarithm of expenditure on food items is 7.93 with a standard deviation of 0.68. The high standard deviation around the mean is indicative of the high variability in the size of expenditure among the households. This might also be associated with greater downside risk to food

shortages. The average family size is approximately seven members while the normal schooling attained by the household head is 1.73 that is about the 8th class of schooling. Access to credit is regarded as a way of easing liquidity constraints for households. Nearly 35 percent and 25 percent of those households have access to credit from formal and informal sources respectively. Access to a better toilet facility (flush toilet) is regarded as additional safety and protection against sanitation-related diseases; hence, seems an indicator of household welfare. The productivity and other health-related conditions of the household members might have some association with this kind of toilet facilities. Just 16 percent of the household have access to a flush toilet, and 76 percent of the households have access to electricity. About one-third of the household composition is composed of dependents who are below the age of 16 or above age 65. Agroecological differences are included to represent the particular agricultural systems within each area. Agroecological distribution of this sample indicates that 31 percent, 21 percent, 41 percent and 7 percent of the households are located in humid, semi-arid temperate, semi-arid tropic, and arid regions, respectively.

In Figures A1-A10, we draw kernel density curves (given in the appendix) which indicates that average expenditures on food and non-food items are higher for households who report livelihood diversification in non-farm enterprises than for those who do not report. To further examine the connection between NFEs income and diversification in dietary patterns and consumption expenditure, we plot non-parametric association between the logarithm of NFE income versus various outcomes of food and non-food consumption expenditures, their diversities and farm investment in figures A11-A20. It is observed that there is a positive association between NFEs income and expenditures on food items, non-food goods and services, household assets, and farm investment. However, the inferences from the Simpson Index do not confirm any association between NFEs income and indicators of dietary and expenditure diversity. These initial non-parametric findings inspire us to explore farther into the nature of these associations using parametric regressions in the next section.

Table 4.1: Summary Statistics of the Principal Variables used in the Study (N = 1,822)

Variable	Description	Mean	Std. Dev.
Outcome Variables:			
ln food exp	natural logarithm of expenditure on food items	7.93	0.68
food exp share	share of food expenditure in total consumption expenditure	0.48	0.18
ln cereals exp	natural logarithm of expenditure on cereals	6.57	0.68
non-cereals ratio	the ratio of non-cereals expenditure in cereals expenditure	3.80	6.84
ln non-veg exp	natural logarithm of expenditure on fish, meat and chicken	5.49	0.99
dietary diversity	simpson index of dietary diversity	0.76	0.09
ln non-food exp	natural logarithm of expenditure on non-food items	6.87	1.09
ln hh assets	natural logarithm of expenditure on household assets	7.18	1.44
ln farm investment	natural logarithm of expenditure/investment on working capital	6.50	1.38
expenditure diversity	simpson index of expenditure diversity	0.58	0.12
Endogenous Variable:			
ln NFE income	natural logarithm of income received from rural non-farm enterprises	7.34	1.33
Instrumental Variables:			
nwork NFE	number of household members are engaged in nonfarm enterprises	1.26	0.83
road density	the ratio of the district's total road network to the district's land area	6.27	0.62
Control Variables:			
caste	1=general; 2=other backward castes (obc); 3=scheduled castes (sc); 4=scheduled tribes (st)	2.00	1.06
religion	1=hindu; 2=muslims; 3=others	1.17	0.48
education	0=illiterate; 1=primary (upto 8th class); 2=senior secondary (9 to 12); 3=graduation & above	1.73	0.93
mpce	monthly per-capita consumption expenditure in INR (Indian Rupees)	1182.46	1880.77
toilet	0=no toilet; 1=traditional pit; 2=semi-flush; 3=flush	1.17	1.17
hh size	number of members in the household	6.85	3.65
child	number of children (below 14 years of age) in the household	1.66	1.60
elder	number of elders (above 65 years of age) in the household	0.63	0.78
electricity	0=no; 1=yes	0.79	0.41
land Class	1=marginal (<1 ha land); 2=small (1-2 ha land); 3=medium (2-4 ha land); 4=large (>4 ha land)	1.93	1.02
agroecological zones	1=humid; 2=semi-arid temperate; 3=semi-arid tropical; 4=arid	2.17	0.99
livestocks	1=no livestock; 2= 1 to 5; 3=6 to 10; 4=11 & above	1.17	0.80
credit	0=no loan; 1=loan taken from informal institution;	0.96	0.80

Variable	Description	Mean	Std. Dev.
	2=loan taken from formal institution		
credit savings	0=no; 1=yes (membership of credit saving associations)	0.10	0.30
cooperative	0=no; 1=yes (membership of agri-cooperatives)	0.13	0.34

4.4.2. Panel Regression

Equation (4.2) is estimated both with and without the instrumental variable method, using the non-farm enterprises' income as a main explanatory variable for 10 different outcomes and results of panel regressions are reported in Table 4.2. Ignoring the endogeneity problem and using panel regression estimations, we find that non-farm enterprises income is positively and significantly associated with food consumption expenditure, dietary diversity, expenditure on non-vegetarian food items, and the ratio of expenditure on non-cereals to cereals; NFE income is negatively related to the share of expenditure on food consumption in total consumption. We also explored whether income from non-farm enterprises affects expenditure diversity and farm investment in rural India. We find that NFE income, controlling for household characteristics, is positively and significantly associated with expenditure diversity and more investment in agricultural activities.

The results from panel regression indicate that an additional percent of NFEs income is likely to increase food consumption, non-cereals ratio, expenditures on non-vegetarian food items and dietary diversity by 0.10 percent, 0.31 percent, 0.17 percent, and 0.01 percent respectively. Table 4.2 also shows the positive and significant association between NFEs income and different outcomes of non-food expenditure and farm investment. The result indicates that a 1 percent increase in non-farm enterprises income increased non-food expenditure, household durable goods expenditure and farm investment by 0.20 percent, 0.21 percent, and 0.14 percent respectively. Our results are in accordance with the findings from (Imai, Gaiha and Thapa, 2015) that the decrease in economic vulnerability from non-farm earnings is a lot greater for more comparatively skilled employment. These outcomes will

also be in accord with the existing evidence from various other nations. (Babatunde and Qaim, 2010) discover that larger non-farm earnings in Nigeria contribute to higher calorie intake and improved diet quality. (Zereyesus *et al.*, 2017) show that non-farm work has a significant role in mitigating the risk of food poverty among the poorest of households in northern Ghana. However, the relationship is not causal. There is an endogeneity issue that renders our panel estimates biased. Of all the outcomes included in the analysis, the non-cereal ratio had the most compelling correlation with the NFEs income, followed by expenditure on durable household assets. In both cases, the association was most plausibly attributed to an income effect.

The results reported in Table 4.2 also explains that households with higher education level spend lesser on food, more on cereals, also have higher dietary diversity. Households that possess membership of agricultural cooperatives to spend less on food as well as on cereals if their NFE income increases; those with access to flush toilets spend more on proteins (egg, fish, and meat) and these households have greater dietary diversity as against those who do not have access to improved toilets. Our results are robust to various specifications in which we begin with a lean version with only our primary explanatory variable and include more variables in following specifications. These results may be biased due to the endogeneity consequences associated with NFE income. Therefore, we need instruments to correct for the biases.

4.4.3. Panel IV Regression

As mentioned in the previous section, we select two distinct instruments to deal with the endogeneity problem in the OLS estimates. We find that both our chosen instruments affirm the OLS results. Table 4.3 reports the results of the panel IV regression with both road density and number of household members participated in non-farm enterprises as the instruments. When we use both instrument variables together for panel regression, we find

that for one percent rise in NFE income for a farm household in our sample, is likely to increase a 0.17 percent spending on food items, 0.05 percent increase in the dietary diversity measure, 0.36 percent rise in the expenditure spent on non-vegetarian food items. Our instrument is also positively associated with the ratio of expenditure on non-cereal to the corresponding expenditure on cereals. We also find that non-farm enterprises income is also negatively associated with the share of food expenditure in total consumption expenditure. Our results show that livelihood diversification in rural non-farm enterprises in India, eases household's budget constraints, leading to greater consumption of food (spending on nutritious food items like egg, fish, and meat increases, in particular) and more diverse diet pattern.

We identify the relationship by using the same instruments for NFEs income to measures of expenditure diversity and farm investment. We argue that road density and number of household members engaged in non-farm enterprises would affect NFEs income while the income received through non-farm enterprises will influence the household non-food expenditure and farm investment. Table 4.3 shows the results for our instrument variables exercise. We find that income from non-farm enterprise leads to greater spending on non-food goods and services. We also document that households with greater NFEs income spend more on household assets and invest more in agricultural activities. We also find that NFEs income does have a statistically significant effect on expenditure diversity measure. All control variables have expected signs. More educated households enjoy better non-food expenditure indicators including diversity indexes. Similarly, households with flush toilets and electricity have greater expenditure diversity. Households which report elder members have lower dietary diversity, and those who have more children have greater dietary diversity.

4.4.4. The Validity of Instrumental Variables

The validity of an instrument mainly depends on two conditions, namely, significance and exogeneity. For the prior to be more fulfilled, the variation in the endogenous explanatory variable needs to be explained by the instrument. For the latter, the selected instrument needs to be orthogonal to the outcome variable of interest. While we had already given a theoretical justification for the exogeneity of the instruments, we focus on the significance of the instruments in this section. To accomplish this, we provide the first stage estimates for each of our chosen instruments in Table A1. The first stage F-statistics for different instruments are also shown to be well over the cut-off F-statistic of 10 (Staiger and Stock, 1997) indicating that the selected instruments are relevant and explain the variation in non-farm enterprises income.

Table 4.2: Panel Regression: Non-Farm Enterprises Income and Diversifications in Consumption Expenditures

	ln food exp	food exp share	ln cereals exp	non-cereals ratio	ln non-veg exp	Dietary Diversity	ln non-food exp	ln hh assets	ln farm investment	Exp Diversity
ln NFE Inc	0.104***	-0.024***	0.023*	0.309*	0.166***	0.014***	0.197***	0.213***	0.142***	0.016***
	(14.81)	(-9.15)	(2.47)	(2.47)	(8.86)	(10.17)	(14.02)	(12.06)	(8.08)	(8.88)
Caste										
obc	0.026	-0.002	0.078**	-0.773*	0.104*	0.009*	-0.023	0.035	-0.004	0.019***
	(1.35)	(-0.30)	(3.04)	(-2.20)	(2.03)	(2.44)	(-0.61)	(0.73)	(-0.09)	(3.64)
sc	-0.14***	0.103***	-0.002	-0.411	-0.105	-0.043***	-0.630***	-0.70***	-0.657***	-0.05***
	(-5.07)	(10.11)	(-0.05)	(-0.85)	(-1.60)	(-7.89)	(-11.63)	(-10.22)	(-9.69)	(-6.73)
st	-0.056*	-0.015	-0.075*	-0.579	-0.059	0.012*	0.115*	-0.024	-0.060	-0.004
	(-2.43)	(-1.79)	(-2.44)	(-1.38)	(-1.02)	(2.54)	(2.51)	(-0.41)	(-1.05)	(-0.69)
Religion										
muslim	0.135***	0.027*	0.141***	0.138	0.464***	0.014*	0.103	-0.067	0.136	0.003
	(4.36)	(2.27)	(3.48)	(0.26)	(7.37)	(2.22)	(1.64)	(-0.86)	(1.73)	(0.40)
others	-0.122**	-0.004	-0.138*	-0.063	-0.014	0.006	-0.087	-0.103	-0.127	0.011
	(-2.96)	(-0.22)	(-2.55)	(-0.09)	(-0.13)	(0.74)	(-1.02)	(-1.00)	(-1.20)	(1.03)
Education										
primary	0.155***	0.017	0.156***	-0.071	-0.007	-0.004	0.195***	-0.009	0.342***	0.045***
	(5.51)	(1.57)	(4.19)	(-0.14)	(-0.11)	(-0.80)	(3.43)	(-0.13)	(4.81)	(6.18)
secondary	0.183***	-0.009	0.151***	0.461	0.060	0.004	0.356***	0.159*	0.192**	0.051***
	(6.60)	(-0.90)	(4.11)	(0.94)	(0.91)	(0.76)	(6.35)	(2.27)	(2.74)	(7.23)
grad & above	0.228***	-0.003	0.246***	-0.091	0.049	-0.008	0.406***	0.180*	0.461***	0.067***
	(7.25)	(-0.24)	(5.93)	(-0.16)	(0.65)	(-1.22)	(6.42)	(2.28)	(5.81)	(8.30)
MPCE	0.000***	-0.000***	0.000***	0.000***	0.000***	-0.000*	0.000***	0.000***	0.000***	-0.00***
	(18.80)	(-17.91)	(6.67)	(3.75)	(4.67)	(-2.47)	(9.97)	(26.49)	(6.85)	(-12.58)
Toilet										
traditional	0.372***	-0.005	0.167***	0.720	0.468***	0.036***	0.424***	0.289***	0.360***	0.059***
	(17.80)	(-0.58)	(5.95)	(1.88)	(8.69)	(8.46)	(10.24)	(5.49)	(6.96)	(11.09)
semi-flush	0.486***	-0.000	0.260***	0.444	0.593***	0.029***	0.540***	0.308***	0.507***	0.081***

	ln food exp	food exp share	ln cereals exp	non-cereals ratio	ln non-veg exp	Dietary Diversity	ln non-food exp	ln hh assets	ln farm investment	Exp Diversity
	(15.13)	(-0.05)	(6.30)	(0.80)	(7.84)	(4.61)	(8.75)	(3.95)	(6.56)	(10.27)
flush	0.423***	0.003	0.202***	0.482	0.609***	0.019***	0.497***	0.230***	0.600***	0.086***
	(17.27)	(0.38)	(6.12)	(1.08)	(9.03)	(3.77)	(10.19)	(3.72)	(9.88)	(13.71)
hh size	0.064***	0.003**	0.089***	-0.080	0.034***	-0.000	0.050***	0.062***	0.018**	-0.001
	(24.74)	(3.22)	(25.44)	(-1.70)	(4.80)	(-1.15)	(9.58)	(9.49)	(2.73)	(-1.92)
child	0.028***	0.003	0.017*	0.077	0.010	-0.004***	0.003	0.011	0.052***	0.000
	(4.84)	(1.50)	(2.22)	(0.79)	(0.68)	(-3.30)	(0.29)	(0.77)	(3.62)	(0.15)
elder	0.005	-0.006	-0.014	-0.118	0.014	0.002	-0.006	0.044	-0.125***	-0.01***
	(0.48)	(-1.55)	(-1.06)	(-0.66)	(0.55)	(0.93)	(-0.31)	(1.69)	(-4.71)	(-3.99)
electricity	0.163***	-0.018*	0.010	0.899*	0.355***	0.009*	0.249***	0.202***	0.292***	0.039***
	(7.71)	(-2.26)	(0.37)	(2.41)	(6.87)	(2.21)	(5.82)	(3.79)	(5.50)	(7.21)
Land Class										
small	0.024	-0.003	0.082**	0.328	-0.114*	-0.017***	-0.035	0.090	0.616***	-0.010
	(1.21)	(-0.37)	(3.21)	(0.96)	(-2.26)	(-4.31)	(-0.90)	(1.84)	(12.80)	(-1.96)
medium	0.094***	0.000	0.089**	0.428	-0.049	-0.012*	0.091	0.092	1.028***	0.002
	(3.88)	(0.01)	(2.77)	(0.99)	(-0.78)	(-2.46)	(1.86)	(1.50)	(17.13)	(0.39)
large	0.041	-0.043***	0.047	-0.022	0.145	0.000	0.106	0.279***	1.477***	0.021**
	(1.44)	(-4.02)	(1.26)	(-0.04)	(1.93)	(0.15)	(1.87)	(3.93)	(18.93)	(2.87)
Agroecological Zones										
SA - temperate	0.217***	0.052***	-0.088**	1.266**	-0.040	-0.017***	0.119*	-0.125*	0.673***	0.021***
	(9.29)	(5.82)	(-2.88)	(3.16)	(-0.59)	(-3.56)	(2.50)	(-2.12)	(11.33)	(3.45)
SA - tropics	-0.020	0.024**	-0.253***	1.293***	-0.078	0.0115**	-0.050	-0.24***	0.119*	0.024***
	(-1.04)	(3.22)	(-9.94)	(3.88)	(-1.64)	(2.95)	(-1.25)	(-4.91)	(2.38)	(4.78)
arid	0.298***	0.040**	-0.153**	1.854**	0.055	-0.032***	0.179*	0.067	0.721***	0.016
	(7.98)	(2.82)	(-3.15)	(2.89)	(0.42)	(-4.23)	(2.36)	(0.70)	(7.48)	(1.72)
Livestocks										
1 to 5	0.09***	-0.012	0.185***	-1.811***	-0.067	-0.007	0.126**	0.191***	0.072	-0.003
	(4.13)	(-1.49)	(6.32)	(-4.63)	(-1.24)	(-1.58)	(2.84)	(3.43)	(1.24)	(-0.50)

	ln food exp	food exp share	ln cereals exp	non-cereals ratio	ln non-veg exp	Dietary Diversity	ln non-food exp	ln hh assets	ln farm investment	Exp Diversity
6 to 10	0.156***	0.014	0.198***	-1.166*	-0.103	-0.015**	0.132*	0.100	0.063	0.002
	(5.59)	(1.30)	(5.33)	(-2.35)	(-1.49)	(-2.64)	(2.36)	(1.43)	(0.88)	(0.22)
11 & above	0.171***	0.014	0.273***	-1.727**	0.035	-0.016*	0.187**	0.125	0.196*	0.013
	(5.11)	(1.10)	(6.13)	(-2.90)	(0.45)	(-2.35)	(2.78)	(1.48)	(2.33)	(1.47)
Credit										
informal	0.014	-0.046***	0.077**	0.203	0.002	0.004	0.232***	0.263***	0.169***	0.016**
	(0.76)	(-6.55)	(3.08)	(0.60)	(0.03)	(1.07)	(6.20)	(5.56)	(3.57)	(3.24)
formal	0.005	-0.044***	0.034	-0.271	-0.054	0.007	0.183***	0.247***	0.205***	0.008
	(0.25)	(-5.89)	(1.26)	(-0.76)	(-1.04)	(1.80)	(4.60)	(4.91)	(4.07)	(1.57)
Membership										
credit savings	0.057*	0.017*	-0.030	0.750	0.306***	0.023***	0.012	-0.031	0.080	0.020**
	(2.19)	(2.00)	(-0.86)	(1.58)	(4.81)	(4.38)	(0.24)	(-0.46)	(1.23)	(2.96)
cooperative	0.029	-0.082***	0.023	-0.665	0.239***	0.001	0.255***	0.508***	0.264***	0.006
	(1.25)	(-9.66)	(0.74)	(-1.58)	(3.57)	(0.31)	(5.69)	(8.86)	(4.80)	(0.99)
_cons	5.838***	0.708***	5.296***	1.151	3.288***	0.653***	3.919***	4.051***	3.564***	0.342***
	(101.70)	(32.69)	(69.48)	(1.12)	(22.71)	(56.59)	(34.00)	(27.98)	(24.49)	(23.20)
N	1822	1822	1822	1822	1822	1822	1822	1822	1822	1822
R-square	0.693	0.398	0.447	0.157	0.467	0.240	0.513	0.559	0.554	0.343

Note: *Significance level of the difference: * p<0.05, ** p<0.01, *** p<0.001*
Robust standard errors clustered at the district-level in parentheses.
Omitted groups: *Caste:* general. *Religion:* hindu. *Education:* illiterate. *Toilet Facility:* no toilet (open field). *Land Class:* marginal. *Agro-ecological Zones:* humid. *Livestocks:* no livestock. *Credit:* no loan is taken.
MPCE refers to *monthly per capita expenditure*

Table 4.3: Panel IV Regression: Non-Farm Enterprises Income and Diversifications in Consumption Expenditures (IV: nwork NFE and Road Density)

	ln food exp	food exp share	ln cereals exp	non-cereals ratio	ln non-veg exp	Dietary Diversity	ln non-food exp	ln hh assets	ln farm investment	Exp Diversity
ln NFE Inc	0.17***	-0.047***	0.219***	-1.110	0.359***	0.054***	0.511***	0.304***	0.179*	0.08***
	(4.86)	(-3.61)	(4.61)	(-1.82)	(4.97)	(7.05)	(6.97)	(3.58)	(2.02)	(7.28)
Caste										
obc	0.015	-0.003	0.036	-0.498	0.089	0.004	-0.062	0.037	-0.005	0.007
	(0.71)	(-0.44)	(1.20)	(-1.31)	(1.62)	(0.78)	(-1.40)	(0.72)	(-0.11)	(1.13)
sc	-0.096**	0.082***	0.128*	-1.422*	0.033	-0.014	-0.406***	-0.62***	-0.632***	-0.006
	(-2.66)	(5.99)	(2.49)	(-2.17)	(0.39)	(-1.69)	(-5.23)	(-6.88)	(-6.98)	(-0.57)
st	-0.066**	-0.013	-0.114**	-0.334	-0.088	0.004	0.065	-0.040	-0.064	-0.015
	(-2.74)	(-1.43)	(-3.27)	(-0.75)	(-1.43)	(0.64)	(1.24)	(-0.65)	(-1.05)	(-1.96)
Religion										
muslims	0.096**	0.033**	0.082	0.318	0.435***	0.013	0.022	-0.120	0.069	-0.008
	(2.94)	(2.64)	(1.80)	(0.55)	(6.42)	(1.81)	(0.31)	(-1.47)	(0.85)	(-0.79)
others	-0.120**	-0.002	-0.139*	-0.042	-0.050	0.007	-0.079	-0.109	-0.130	0.010
	(-2.90)	(-0.16)	(-2.42)	(-0.06)	(-0.45)	(0.77)	(-0.88)	(-1.06)	(-1.24)	(0.82)
Education										
primary	0.15***	0.018	0.137***	0.062	-0.022	-0.009	0.160*	-0.006	0.356***	0.04***
	(5.24)	(1.65)	(3.40)	(0.12)	(-0.32)	(-1.45)	(2.56)	(-0.08)	(4.94)	(4.55)
secondary	0.17***	-0.003	0.088*	0.914	0.008	-0.009	0.251***	0.140	0.198*	0.04***
	(5.43)	(-0.25)	(2.07)	(1.67)	(0.11)	(-1.31)	(3.82)	(1.85)	(2.57)	(3.73)
grad & above	0.21***	-0.000	0.187***	0.426	-0.035	-0.025**	0.308***	0.172*	0.454***	0.05***
	(6.15)	(-0.01)	(3.88)	(0.69)	(-0.40)	(-3.18)	(4.18)	(2.02)	(5.24)	(4.50)
MPCE	0.00***	-0.000***	0.000	0.000***	0.000	-0.000***	0.000***	0.000***	0.000***	-0.0***
	(12.52)	(-11.90)	(1.80)	(4.24)	(1.49)	(-5.33)	(3.65)	(19.00)	(4.84)	(-11.77)
Toilet										
traditional	0.34***	0.005	0.051	1.442**	0.367***	0.017**	0.276***	0.238***	0.329***	0.03***
	(12.75)	(0.50)	(1.33)	(2.92)	(5.52)	(2.70)	(4.82)	(3.55)	(4.92)	(3.71)

	ln food exp	food exp share	ln cereals exp	non-cereals ratio	ln non-veg exp	Dietary Diversity	ln non-food exp	ln hh assets	ln farm investment	Exp Diversity
semi-flush	0.42***	0.017	0.123*	1.346	0.476***	0.004	0.320***	0.228*	0.453***	0.04***
	(11.14)	(1.21)	(2.28)	(1.94)	(5.31)	(0.43)	(3.91)	(2.40)	(4.78)	(3.53)
flush	0.38***	0.012	0.053	1.456*	0.470***	-0.010	0.296***	0.191*	0.585***	0.05***
	(11.45)	(0.94)	(1.10)	(2.37)	(5.53)	(-1.25)	(4.14)	(2.29)	(7.31)	(4.49)
hh size	0.06***	0.004***	0.075***	0.013	0.019*	-0.003***	0.030***	0.057***	0.014	-0.01**
	(18.02)	(3.38)	(15.60)	(0.21)	(2.09)	(-4.07)	(4.18)	(6.81)	(1.66)	(-5.03)
child	0.03***	0.003	0.017*	0.067	0.009	-0.004**	0.004	0.011	0.053***	0.000
	(4.82)	(1.55)	(2.15)	(0.66)	(0.60)	(-2.88)	(0.33)	(0.76)	(3.70)	(0.21)
elder	0.000	-0.003	-0.029*	-0.016	0.005	-0.000	-0.030	0.035	-0.130***	-0.02**
	(0.08)	(-0.96)	(-1.99)	(-0.10)	(0.20)	(-0.05)	(-1.28)	(1.31)	(-4.65)	(-4.49)
electricity	0.14***	-0.012	-0.044	1.258**	0.295***	0.000	0.164***	0.169**	0.268***	0.023**
	(6.16)	(-1.37)	(-1.37)	(3.04)	(5.14)	(0.19)	(3.29)	(2.94)	(4.70)	(3.28)
Land Class										
small	0.031	-0.006	0.112***	0.247	-0.010	-0.017***	-0.014	0.109*	0.638***	-0.007
	(1.54)	(-0.74)	(4.06)	(0.70)	(-1.88)	(-3.72)	(-0.32)	(2.22)	(13.16)	(-1.16)
medium	0.09***	0.002	0.069*	0.624	-0.041	-0.019***	0.052	0.095	1.045***	-0.006
	(3.58)	(0.18)	(1.97)	(1.38)	(-0.62)	(-3.31)	(0.96)	(1.51)	(17.16)	(-0.83)
large	0.020	-0.035**	-0.013	0.517	0.100	-0.015*	-0.012	0.251**	1.493***	-0.004
	(0.64)	(-2.91)	(-0.29)	(0.92)	(1.24)	(-2.16)	(-0.17)	(3.18)	(18.29)	(-0.39)
Agroecological Zones										
SA - temperate	0.21***	0.056***	-0.120***	1.478***	-0.079	-0.023***	0.074	-0.134*	0.683***	0.012
	(8.83)	(6.12)	(-3.63)	(3.48)	(-1.09)	(-4.22)	(1.41)	(-2.23)	(11.16)	(1.58)
SA - tropics	-0.015	0.025***	-0.257***	1.275***	-0.093	0.012**	-0.043	-0.24***	0.126*	0.03***
	(-0.74)	(3.31)	(-9.60)	(3.71)	(-1.89)	(2.86)	(-1.00)	(-4.91)	(2.53)	(4.33)
arid	0.29***	0.045**	-0.203***	2.178**	0.070	-0.040***	0.113	0.047	0.719***	0.003
	(7.50)	(3.14)	(-3.85)	(3.23)	(0.52)	(-4.74)	(1.36)	(0.49)	(7.36)	(0.28)
Livestocks										
1 to 5	0.10***	-0.017	0.221***	-2.071***	-0.047	-0.000	0.180***	0.209***	0.080	0.008
	(4.30)	(-1.88)	(6.78)	(-4.96)	(-0.81)	(-0.05)	(3.57)	(3.59)	(1.30)	(1.16)

	ln food exp	food exp share	ln cereals exp	non-cereals ratio	ln non-veg exp	Dietary Diversity	ln non-food exp	ln hh assets	ln farm investment	Exp Diversity
6 to 10	0.17***	0.011	0.248***	-1.546**	-0.065	-0.005	0.204**	0.112	0.062	0.017
	(5.69)	(0.96)	(5.92)	(-2.88)	(-0.88)	(-0.78)	(3.17)	(1.50)	(0.83)	(1.89)
11 & above	0.18***	0.015	0.302***	-1.927**	0.043	-0.011	0.221**	0.117	0.186*	0.020
	(5.15)	(1.14)	(6.24)	(-3.10)	(0.53)	(-1.44)	(2.98)	(1.36)	(2.17)	(1.87)
Credit										
informal	0.029	-0.053***	0.128***	-0.071	0.048	0.009*	0.293***	0.298***	0.187***	0.03***
	(1.44)	(-7.05)	(4.51)	(-0.19)	(0.91)	(1.99)	(6.78)	(5.94)	(3.75)	(4.53)
formal	0.008	-0.049***	0.042	-0.299	-0.063	0.008	0.194***	0.268***	0.220***	0.009
	(0.39)	(-6.32)	(1.45)	(-0.81)	(-1.15)	(1.74)	(4.41)	(5.26)	(4.32)	(1.47)
Membership										
credit savings	0.068*	0.016	-0.011	0.513	0.354***	0.033***	0.076	-0.024	0.098	0.03***
	(2.51)	(1.58)	(-0.27)	(1.03)	(5.18)	(5.26)	(1.29)	(-0.35)	(1.47)	(3.71)
cooperative	0.013	-0.076***	-0.010	-0.328	0.218**	-0.005	0.190***	0.483***	0.256***	-0.008
	(0.51)	(-8.14)	(-0.29)	(-0.72)	(3.09)	(-0.90)	(3.58)	(7.81)	(4.26)	(-1.10)
_cons	5.46***	0.851***	4.130***	9.697**	2.158***	0.415***	2.024***	3.477***	3.329***	-0.029
	(25.99)	(10.71)	(14.18)	(2.60)	(4.96)	(8.87)	(4.49)	(6.65)	(6.06)	(-0.44)
N	1822	1822	1822	1822	1822	1822	1822	1822	1822	1822
R-square	0.684	0.388	0.370	0.126	0.430	0.167	0.454	0.556	0.557	0.226

Note: *Significance level of the difference: * p<0.05, ** p<0.01, *** p<0.001*
Robust standard errors clustered at the district-level in parentheses.
Omitted groups: *Caste:* general. *Religion:* hindu. *Education:* illiterate. *Toilet Facility:* no toilet (open field). *Land Class:* marginal. *Agro-ecological Zones:* humid. *Livestocks:* no livestock. *Credit:* no loan is taken. And MPCE refers to *monthly per capita expenditure*
Instrumental variables: *number of persons engaged in the business of nonfarm enterprises and road density.*

4.5. Concluding Remarks

In the present chapter, we provide a comprehensive overview of non-farm enterprises and diversification of dietary patterns and consumption expenditure in rural India. Taking advantage of IHDS longitudinal dataset (2004-05 – 2011-12) with sample consisted of 1,822 same farm households over-time, which allows us to distinguish total consumption expenditure in several important categories and these different consumption expenditures to be linked with the structure of economic activity and income sources. In particular, we focus on the impact of NFEs income on (i) different food consumption outcomes and dietary diversity, (ii) different non-food expenditure outcomes and expenditure diversity and (iii) farm investment. Insights about how farm households diversify their consumption expenditure can help to understand models of behavioral heterogeneity in demand. This chapter has analyzed the empirical facts that are known about the farm households diversify their consumption expenditure because they become richer, the inherent behavior tends which are considered to induce this procedure, in addition to explaining the various approaches to measuring household dietary and expenditure diversity.

Our estimates suggest that an increase in the non-farm enterprises' income is likely to increase food expenditure, non-food expenditure, durable household assets and farm investment by 0.10 percent, 0.20 percent, 0.21 percent, and 0.14 percent respectively. Likewise, given both instrumental variables, these results will increase to 0.17 percent, 0.51 percent, 0.30 percent, and 0.18 percent respectively. Further, the result confirms that higher accessibility to non-farm enterprises income induces food consumption expenditure share in total expenditure. The findings indicate the importance of accessibility to non-farm enterprises income as a strategy for diversifications in consumption expenditure. To the extent that non-farm enterprises income hastens liquidity constraints on-farm investment.

Appendix

Table 4. A1: Tests of Instrument and Endogeneity

Model	Durbin (score)		Wu-Hausman Test		Decision
	Chi2 statistics	P-values	F Statistics	P-values	
Instrumental Variable = NWORK BUSINESS					
ln food expenditure	4.201	0.040	4.155	0.042	Reject
food expenditure share	0.261	0.609	0.258	0.612	Accept
ln cereals expenditure	10.141	0.001	10.053	0.002	Reject
non-cereals ratio	2.936	0.087	2.902	0.089	Accept
ln non-veg expenditure	5.956	0.015	5.845	0.016	Reject
dietary diversity	35.993	0.000	36.050	0.000	Reject
ln non-food expenditure	18.227	0.000	18.126	0.000	Reject
ln household assets	0.014	0.905	0.014	0.905	Accept
ln farm investment	0.689	0.407	0.679	0.410	Accept
expenditure diversity	17.121	0.000	17.019	0.000	Reject
Instrumental Variable = Road Density					
ln food expenditure	0.255	0.613	0.252	0.616	Accept
food expenditure share	9.567	0.002	9.481	0.002	Reject
ln cereals expenditure	10.083	0.002	9.995	0.002	Reject
non-cereals ratio	5.061	0.025	5.006	0.025	Reject
ln non-veg expenditure	1.138	0.286	1.113	0.292	Accept
dietary diversity	1.736	0.188	1.715	0.190	Accept
ln non-food expenditure	0.771	0.380	0.762	0.383	Accept
ln household assets	7.858	0.005	7.782	0.005	Reject
ln farm investment	20.926	0.000	20.825	0.000	Reject
expenditure diversity	56.910	0.000	57.494	0.000	Reject

Null hypothesis (H_0): Variable is exogenous

Table 4. A2: Over-Identification Test – Hansen's J Test

Model	Hansen's J (score)		Decision
	Chi2 statistics	P-values	
Instrumental Variable = NWORK BUSINESS and Road Density			
ln food expenditure	1.530	0.216	Accept
food expenditure share	8.026	0.005	Reject
ln cereals expenditure	3.409	0.065	Accept
non-cereals ratio	5.492	0.019	Reject
ln non-veg expenditure	0.019	0.892	Accept
dietary diversity	0.393	0.531	Accept
ln non-food expenditure	0.391	0.532	Accept
ln household assets	7.832	0.005	Reject
ln farm investment	12.676	0.000	Reject
expenditure diversity	30.021	0.000	Reject

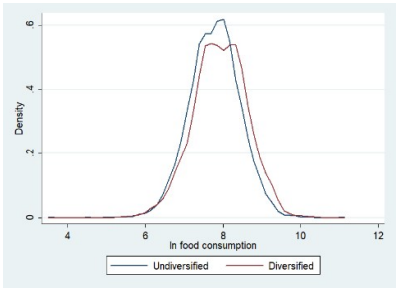
Note: "2SLS Size of nominal 5% Wald test" are 19.93, 11.59, 8.75, and 7.75 and "LIML Size of nominal 5% Wald test" are 8.86, 5.33, 4.42, and 3.92 for 10%, 15%, 20% and 25% respectively.

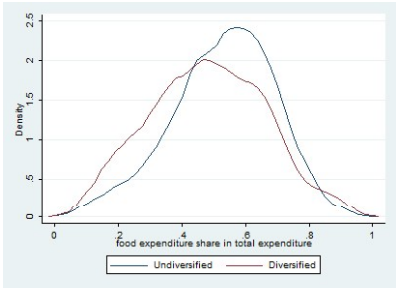
Table 4. A3: Test of Weak Instrument

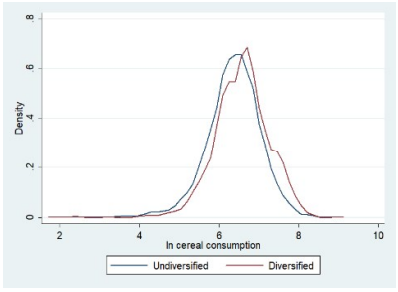
Model	R-square	Adjusted R-square	Partial R-square	Robust F-statistics	P-value
Instrumental Variable = nwork NFE					
ln food expenditure	0.3709	0.3633	0.0393	77.5764	0.0000
food expenditure share	0.3709	0.3633	0.0392	77.4995	0.0000
ln cereals expenditure	0.3701	0.3625	0.0394	77.6401	0.0000
non-cereals ratio	0.3701	0.3625	0.0394	77.6401	0.0000
ln non-veg expenditure	0.4353	0.4229	0.0642	82.8677	0.0000
dietary diversity	0.3709	0.3633	0.0393	77.5764	0.0000
ln non-food expenditure	0.3723	0.3647	0.0398	78.4143	0.0000
ln household assets	0.3713	0.3637	0.0394	77.7199	0.0000
ln farm investment	0.3667	0.3584	0.0402	75.6618	0.0000
expenditure diversity	0.3648	0.3571	0.0382	74.8389	0.0000
Instrumental Variable = road density					
ln food expenditure	0.3490	0.3412	0.0047	14.8470	0.0001
food expenditure share	0.3491	0.3412	0.0047	14.8176	0.0001
ln cereals expenditure	0.3482	0.3403	0.0047	15.0207	0.0001
non-cereals ratio	0.3482	0.3403	0.0047	15.0207	0.0001
ln non-veg expenditure	0.4031	0.3899	0.0081	13.0137	0.0003
dietary diversity	0.3490	0.3412	0.0047	14.8470	0.0001
ln non-food expenditure	0.3504	0.3425	0.0049	15.7593	0.0001
ln household assets	0.3495	0.3416	0.0047	15.0479	0.0001
ln farm investment	0.3415	0.3329	0.0009	2.3044	0.1291
expenditure diversity	0.3434	0.3353	0.0045	14.2278	0.0002
Instrumental Variables = nwork NFE and road density					
ln food expenditure	0.3755	0.3677	0.0451	45.8069	0.0000
food expenditure share	0.3755	0.3677	0.0450	45.7497	0.0000
ln cereals expenditure	0.3747	0.3669	0.0452	45.9334	0.0000
non-cereals ratio	0.3747	0.3669	0.0452	45.9334	0.0000
ln non-veg expenditure	0.4424	0.4296	0.0734	47.4283	0.0000
dietary diversity	0.3755	0.3677	0.0451	45.8069	0.0000
ln non-food expenditure	0.3771	0.3693	0.0459	46.9565	0.0000
ln household assets	0.3759	0.3681	0.0452	45.9778	0.0000
ln farm investment	0.3684	0.3598	0.0416	38.4676	0.0000
expenditure diversity	0.3693	0.3614	0.0439	44.0901	0.0000

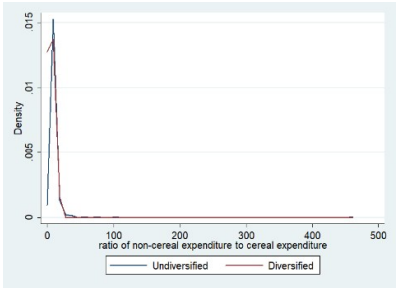
Note: "2SLS Size of nominal 5% Wald test and LIML Size of nominal 5% Wald test" are 16.38, 8.96, 6.66, and 5.53 for 10%, 15%, 20% and 25% respectively.

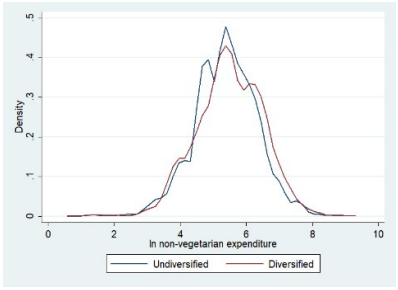
Figures 4. A1 – 4. A10: Kernel Density Estimates: Income received from Rural Non-Farm Enterprises and Diversifications in Consumption Expenditures

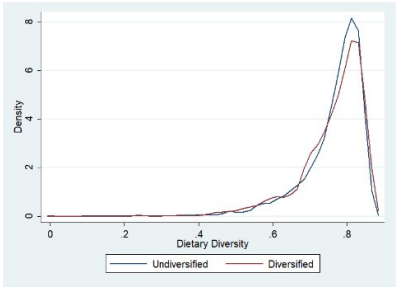


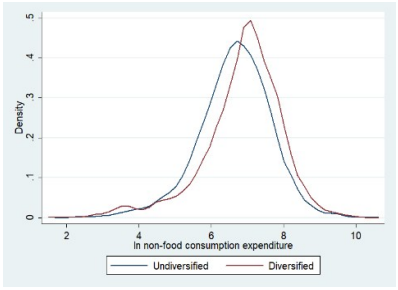


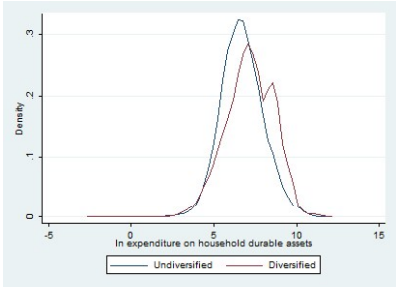


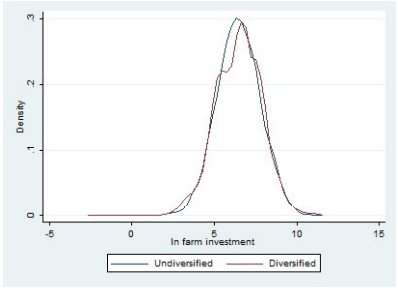


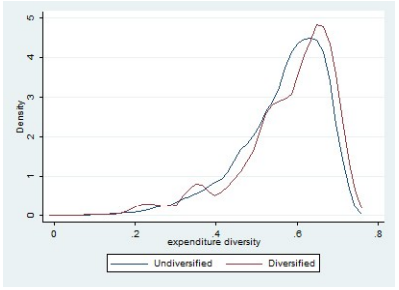




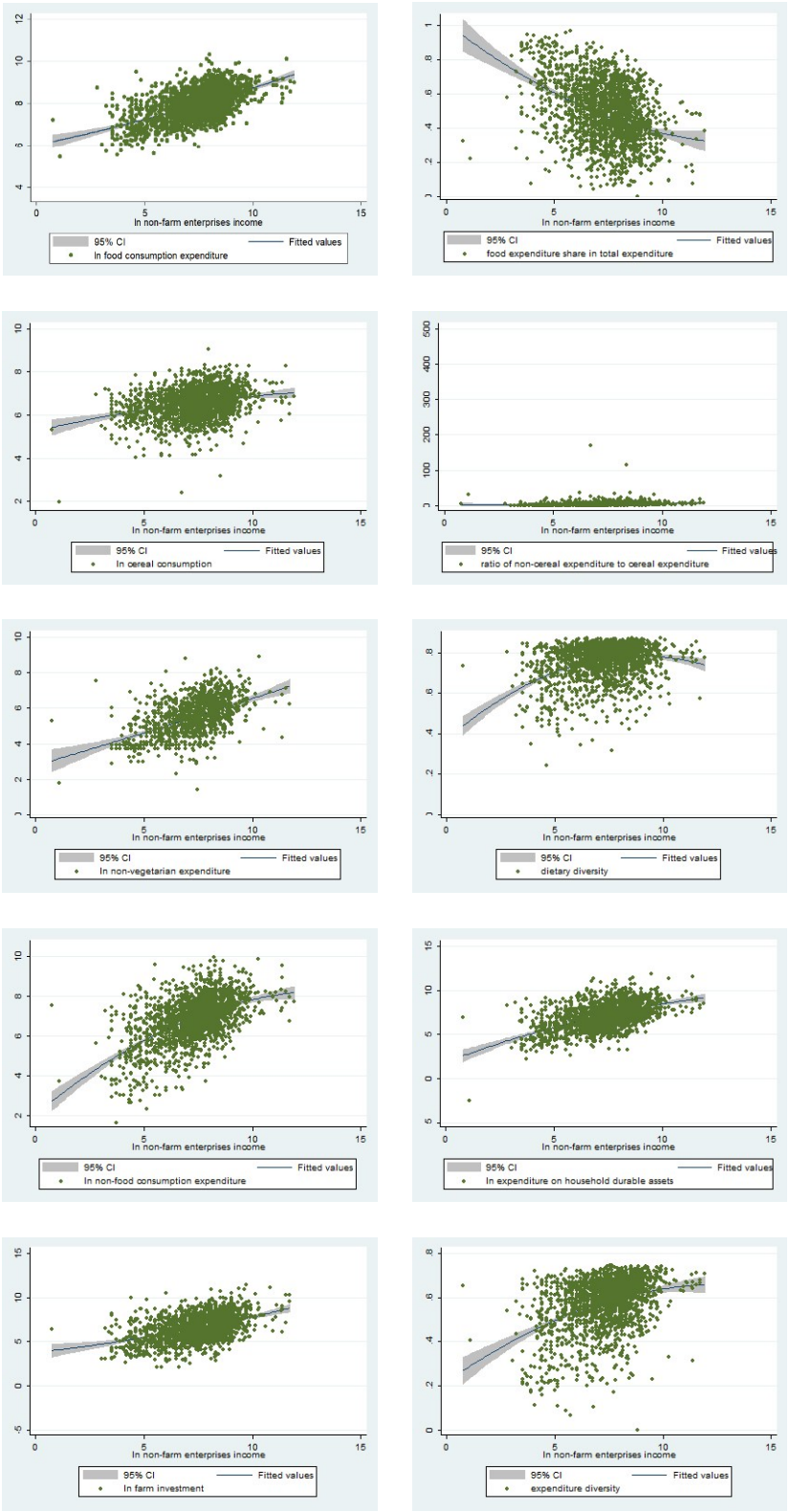








Figures 4. A11 – 4. A20: Non-Parametric Associations of Income received from Rural Non-Farm Enterprises with different Expenditure Indicators



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